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$t=355287708.316$ seconds$=11$ years, 3 months, 7 days, 3 hours, 1 minute, 48.316 seconds.

Also solved by *J. C. CORBIN.*

47. Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics in Columbian University, Washington, D. C.

What is the focus of the convex surface of a plano-convex lens, index μ, which will converge parallel monochromatic rays to a given focus, the rays entering the lens on the plane side?

Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas.

Let f=the given focal length. F=the focal length required,

u=distance of origin of ray from lense,

r, s, the radii of the first and second surfaces of the lense respectively,

t=the thickness, and regard all distances as measured from the posterior surface.

Then we have for for a double convex lense,

$$\frac{1}{\frac{1}{f}+\frac{\mu-1}{s}}-\frac{1}{\frac{1}{u}-\frac{\mu-1}{r}}=\frac{t}{\mu}.$$

(See Parkinson's Optics, Art. 100, Cor. I, page 91).

Let $u=r=\infty$.

$$\therefore \frac{1}{\frac{1}{f}+\frac{\mu-1}{s}}=\frac{t}{\mu} \quad \text{......................................}(1).$$

This is the plano-convex lense with light incident upon plane surface. Write F for f, and let $s=u=\infty$.

$$\therefore \frac{1}{\frac{1}{F}}+\frac{1}{\frac{\mu-1}{r}}=\frac{t}{\mu} \quad \text{......................................}(2).$$

This is the plano-convex lense with light incident upon the convex surface. Since we are using the same lense, $r=s$.

$\therefore\ r=z=\dfrac{(\mu-1)ft}{\mu f-t}$, from (1).

This value of r in (2) gives, $F=-\dfrac{t^2(\mu-1)}{(\mu f-t)^2}$.

$\therefore$ F is found independent of the radius of convexity.